



Photographs by Peter Goin
Essays by Peter Friederici

A NEW FORM of BEAUTY

*Glen Canyon Beyond
Climate Change*

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GLENN CANYON BEYOND CLIMATE CHANGE

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To the waters of the West, and to knowing, experiencing, and visualizing this most essential compound of life

*Nineteenth century
naturalists
learned from the Greeks
that there are only
earth air fire and water*

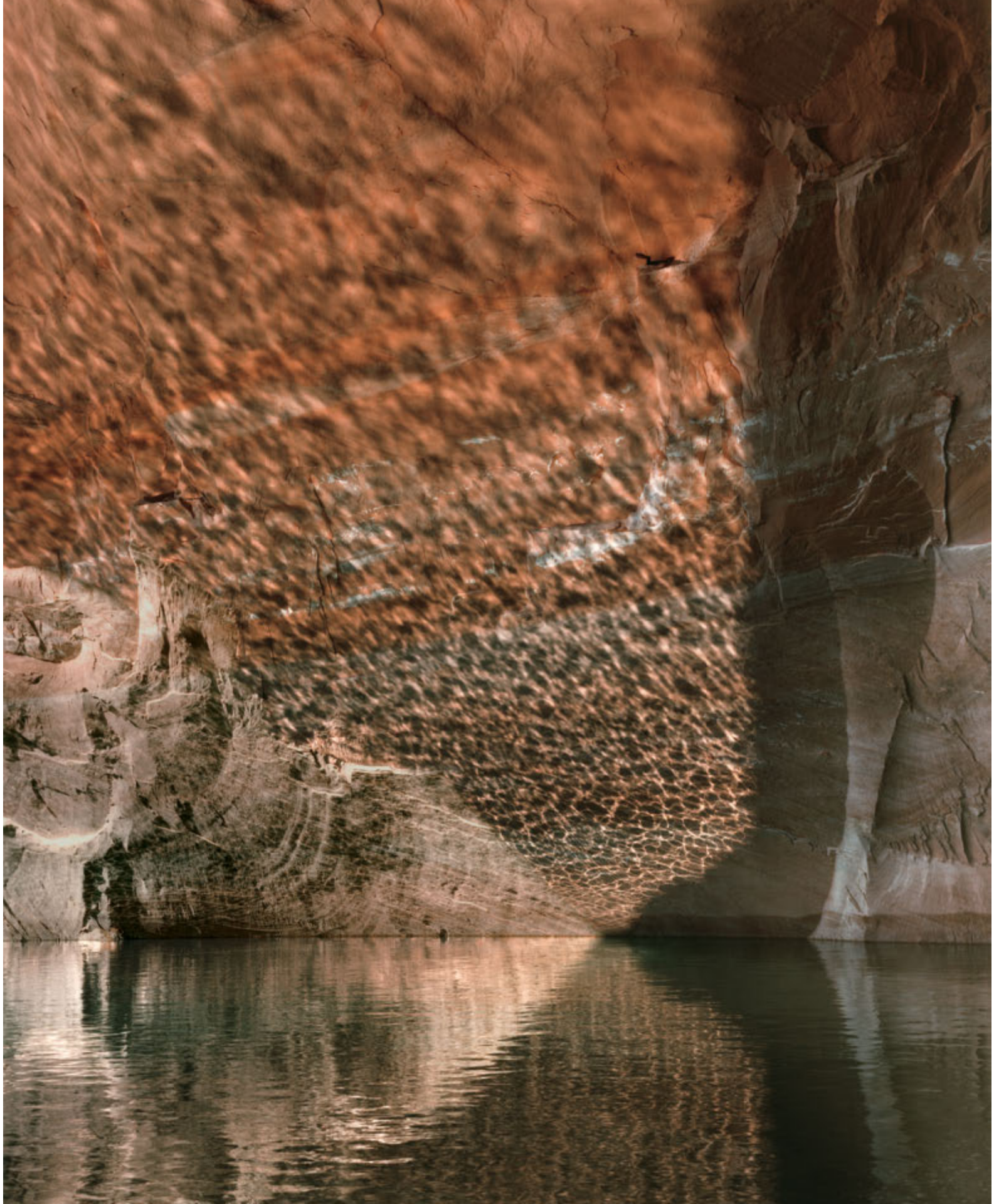
. . .

*Torrents of knowledge
may pour down on us
like red mud
flooding over a cliff
but still we are only
these four strands
arranged in the minds
of rivers*

FROM "ELEMENTS"
ANN WEILER WALKA

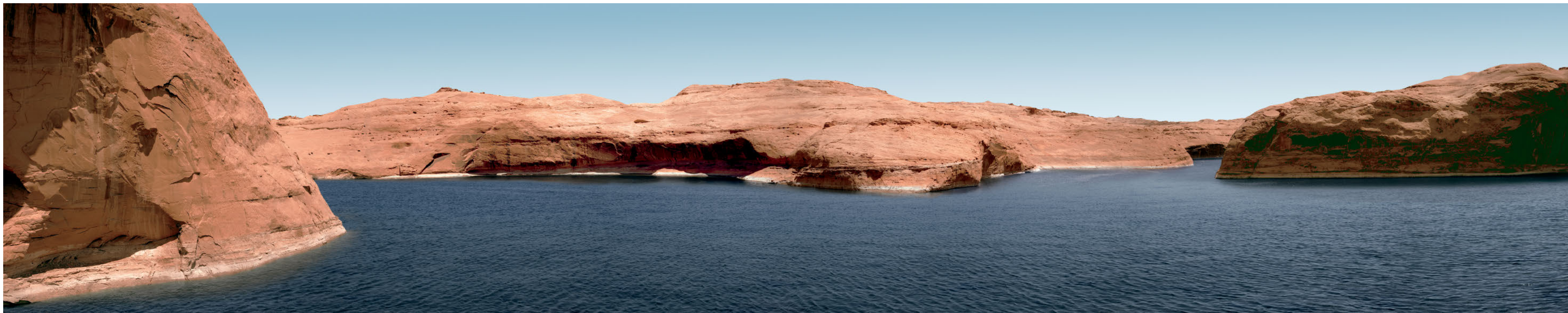
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A NEW FORM OF BEAUTY

A NEW KIND OF DAWN

A few years ago, a cliffside Arizona highway south of the small city of Page collapsed during a winter storm, the roadbed buckling and dropping quickly enough that three cars plunged into the sudden gulf just beyond the headlights. The drivers survived, but the road was badly damaged, its once-smooth blacktop crumbled and split like mud drying in summer sun.

This book is about that moment of falling when the solid ground under us gives way to something new. It is about the vanishing of the second-largest artificial lake in America in the face of the new, potent phenomenon we call climate change. It is about the alarming new calculus of dwindling resources in a land once known for abundance. Though the book focuses on one reservoir in the Colorado River basin, it is really about all our known landscapes as we watch them shape-shift into new forms.

So let me rephrase: the book is less about the moment of falling than about the *recognition* of falling. It is about how all of us are like Coyote in the old cartoons: looking around in shock, backpedaling frantically, as we plunge off a redrock cliff into the hard landing of some brave new dawn.

For almost three decades my friend Peter Goin has been touring the place we call Lake Powell with a large-format camera, cruising its clear waters—by turns emerald, steel gray, turquoise—to show how humans and nature intersect in this wild, constructed waterscape. He has documented both the lake's high-water mark and its low—so far. Both panoramic and intimate, his photographs

are vivid illustrations of the historical moment when the blue-horizon dreams of twentieth- and twenty-first-century America have been giving way to a murkier future—one in which it is unclear not only whether the place we are dealing with is a natural or a human artifact, but even whether it is water, or land, or something in between.

Peter's explorations with a camera mirror my own with notebook and pen. Perhaps it has deepened my fascination with this place that I am almost exactly the same age as Lake Powell, so that I have a predisposition to view it through the lens of growth and maturity and aging and eventual decline.

It is all happening faster than we'd bargained for. Take a look: see the hinge of history swinging, see what it has felt like to witness an iconic landscape as we shape it, and as it shapes us.

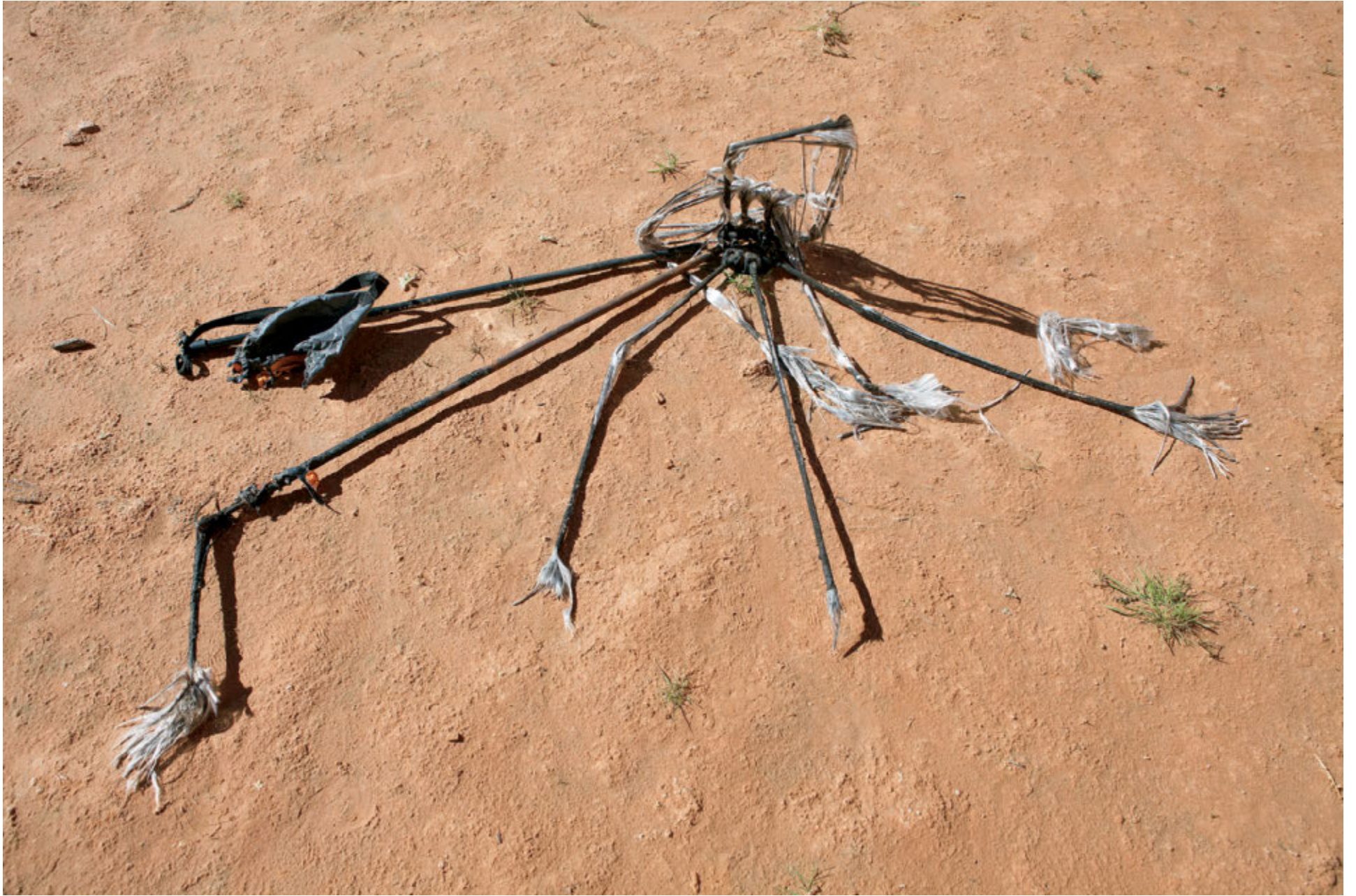




































THE NAMES

Call it a half ton of half-dried clay almost falling on a friend's head. Call it a near natural disaster, the sort of thing liable to happen when you take an excursion out into the wild desert. Call it a sign of how people have pretty much literally mucked up a once pristine place. Call it a mass of sediment with our names on it, our share of the sand and clay and silt that the Colorado River conveys—five hundred pounds for every man, woman, and child living in the United States, each year—and then, when it grows tired, drops off along the way.

The friend was Tim, my partner in kayaking the upper reaches of what we'll have to for convenience call Lake Powell, on the impounded Colorado River, and the half ton was a calving section of cutbank six feet high that happened to topple over just as he paddled alongside.

Happened to? As if anything just happens to happen.

It happened because a couple of minutes earlier a pair of rafts had motored by, heading downstream toward Bullfrog Marina, and their choppy wakes had slapped up against the cutbank, causing sections of it to collapse into the murky river like new icebergs in Greenland.

Or: it happened because the river, in its flux and flow, every year deposits its incredible cargo of mud where the current ceases to flow and the lake begins, and that mud forms new land of a tenuous sort, subject to cracking and slumping and tipping and outright dissolving.

Or: it happened because we after all dammed the river, trapping all that silt that otherwise would have worked its way all the way out to the Gulf of California, and because that stopping of a

natural process that once proceeded entirely without human intervention is only a pale foretaste of the far greater meddling that we're engaged in with the sky over the river, or lake, or whatever we are to call it.

In any case: the bank was covered with calf-high tumbleweeds and small tamarisk shrubs, seeded in lines so precise that you might be forgiven for thinking them the result of human intervention—a perverse field of prickles sown as if to demonstrate just how useless this land is, how devoid of tangible human purpose or profit. It was a place bereft of company—besides the drivers of the two rafts, the two of us saw nobody. You could feel lonely there, get hurt, get bitten by a rattlesnake, twist an ankle and fall into a deep crevasse of mud or rock, vanish entirely, by design or accident.

A wild place, many would say.

But only if that word were to slip as loose of its moorings as the piece of cutbank that nearly walloped my friend. Wild? No. Manicured? Hardly. What this place was, was new. And we had come because the cardinal task of humanity in the epoch of newness that we have created is to come to terms with the novel lands we are building, whether we like it or not.

We paddled downriver, a bit more carefully now, farther from the bank, sections of which kept toppling into the water with reverberating beavertail slaps. On top of each were those sprouts, each as green as springtime incarnate, perfectly promising and new until the very moment it plunged into the murky water, each seedling as unaware of the sudden future as we too often will ourselves to be.



We were there on the hilariously grandiose premise that we might explore this landscape as John Wesley Powell did in 1869.

Yes, *that* John Wesley Powell, the decorated Civil War veteran turned explorer turned interpreter of the new American West to the curious East, the man who outfitted and led the first mission of discovery to make its way through the entire Colorado River chain of canyons from Wyoming to Nevada, picking their way through a land profoundly *weird*: it was a tumbled and in many ways appalling place, given to awful heat and flash floods, dusty windstorms and terrible deluges. It seemed a land not far removed from the throes of initial creation, hardly given to human use—a far cry from the mellow, well-watered predictable hills and hollows they knew back east.

We know now that Powell patched his best-selling account of the expedition together later with many elisions and inaccuracies—but the disquiet that prevailed as he sat with his men at a campfire on a shore downstream of here one evening, at the brink of what we now call Grand Canyon, rings true:

AUGUST 13.—We are now ready to start on our way down the Great Unknown.
. . . We have an unknown distance yet to run, an unknown river to explore.
What falls there are, we know not; what rocks beset the channel, we know not; what walls rise over the river, we know not. Ah, well! we may conjecture many things.

We know not. At our comfortable remove of a century and a half from the trials Powell and his men faced, what a beguiling ring to those words. *We know not*—for isn't the problem of the modern

era that we know so much that none of it means much anymore? Powell's men used heavy brass barometers to estimate how much elevation they lost as they descended into the earth with the river or lugged them up cliffs to measure their height. How thoroughly we have, since then, supersized our information intake: right now, I can click on Google Earth and see exactly where they so labored. It is so easy for us; we are swimming in data, or maybe drowning in torrents of it, so that for many of us turning its flow off is a more pressing task than acquiring more. And so we envy those explorers of an earlier era with more to discover than they had to forget.

So, here is the real unwritten reason Tim and I were there: to immerse ourselves for a spell in a place of mystery where we would not know what to expect, where in fact the central organizing principle of place was a fundamental unknowability, just as Powell surely knew he was only scratching the surface of the canyon country with his wanderings, his note-takings, his scribbles. *We know not*—what a vast refreshment, especially when it comes to a river so thoroughly plumbed and worked over as the Colorado, the workhorse of the southwestern world, the troubled and drying stream of many a planner's contemporary nightmares. For if it was Powell who laid the groundwork for much of today's Southwest with his explorations and, later, his not-quite-successful advocacy for a certain type of settlement restrained by the realities of scarce water, it is the giant reservoir named after him that came to stand for the obverse—for the lush and profligate engorgement with abundant water that still characterizes the modern developed Southwest. It is that comfort which is at risk as we continue to alter the climate, changing the long-held if uneasily forged compact with place that we have hammered out in order to live in our masses in a tough landscape.

To know would be a less fraught accomplishment if the stuff we knew were of a happier nature—the way the builders of Glen Canyon Dam were persuaded that they were fully in the service

of God, progress, and the American way of life. Instead, what we know is this: the Colorado River has since Powell's day been mapped and plumbed and dammed and tapped so that it is now less wild river than a series of water tanks into which the intakes for cities and irrigation districts protrude like great straws. The principal water source for forty million people in the United States and Mexico, the river is so heavily used that it has been deemed responsible for one-twelfth of the entire country's gross domestic product. But the river itself pays the cost, seldom reaching the sea anymore, instead dwindling into final, fetid trickles as it enters the huge delta it anciently created for itself on the Gulf of California.

It is overallocated because of simple American optimism: the planners and politicians who divided its flow in the 1920s used overly optimistic figures for assessing how much water the river had carried and, they figured, would continue to carry. It was a quirk of climatology that they happened to be carving up the pie after a string of wet years. But that led to an outcome perfectly in line with their boosterish outlook. Who could doubt it? Why would God have created these vast lands of sun and promise if not with the manifest intent that they should be peopled by hardworking farmers and ranchers and builders, all of whom needed water to carry out their work?

But this young century has been a hard one so far for the river, and for Lake Powell. In January 2000, the reservoir was 95 percent full; it covered 250 square miles and lapped nearly two thousand miles of deeply indented shoreline in Utah and Arizona. But then the Rocky Mountain winters dried up. By April 2005, after six years of significantly below-average precipitation in the upper Colorado River basin, the lake level had dropped a record 140 feet. The reservoir shrank to less than 130 square miles, diminishing back to the size it was in the late 1960s when it was first

filling. Since then it has risen again, to a level of a hundred feet below its full pool—but this still leaves its volume at only about half what it could be.

Which you might call the ordinary give-and-take of climate, and water engineering, in an arid environment—or it might behoove us to call it something entirely new.

Thus the entirely self-contradictory nature of our trip: we wanted to better understand how a place that is critical both to the engineered infrastructure of the Southwest and to the region's self-understanding is changing and will continue to change in the face of an altered climate—to *know*, in other words—and at the same time to revel in the unresolved mystery of place, to experience it pure of preconception—to *know not*. An impossible challenge, like writing poetry and prose at the same time, or dreaming while awake.

So here was a slab of hardened mud falling from a riverbank, not so close to Tim as to be a real threat, but still near enough that he was drenched with a splash of brown water and could taste the silt: a human-made artifact to be sure, topped with the seedlings of plants imported from Eurasia that tend to outcompete the native species, and here only because of the massive concrete slab thrown across the river's passage, the whole scene standing as evidence of a place denatured, bereft of any sort of self-willed direction, and at the same time a wild thing that could kill you, outside any human control.

And we? Tim and I continued to kayak downstream, ripping along fast in the current, and as the stacks of mud toppled and the muddy water splashed like a thing alive we acted just like excited children, raising a loud cheer with every new impact, wanting nothing more than to witness a bigger fall, a louder crash.



More prosaically, you might say that we'd come up here to the upper reaches of Lake Powell to examine what it looks like where a river dies—or, conversely, when it is coming back to life. And through a quirk of geography and timing we'd come exactly to the right place. A day earlier we'd worked our kayaks down a tributary drainage at the end of the road: first lugging the boats for a half mile along a sandy wash, then putting in to a crooked finger of still water pooled between canyon walls.

I'd been to the same place ten years earlier, at a time of what people in the Southwest were calling drought as if it were worth labeling as something out of the ordinary, and had seen a hundred seeps where water was gushing or trickling out of those fractured cliffs: the hidden surplus Lake Powell had stashed away underground through years of plenty, now running out of its rocky vaults into the light of day.

Ten years later the cliffs were dry, and a sense of poverty had come to be the new normal. But the paddling was sublime, there was no wind, and after a mile of easy travel we'd surely soon round the last corner onto the broader expanse of the main-stem channel.

No, it was not to be. As we turned we saw before us not a slack-water pool but an undulating line of white sand dunes. We weren't done portaging yet.

Not until we crossed the sand, and before we got through them we had to walk between a series of eerie mud pots, some as small as a frying pan, the larger ones as big as a child's backyard swimming pool; the oleaginous gray mud sloped upward from the rim in the shape of a shield volcano, and in the center of each pot was a circular crater from which water occasionally and unpredictably

burped out as if the entire riverbank were engaged in some act of breathing. It was hard to resist stepping bare-legged into one of the pots just to check the consistency of the mud, or to ascertain whether it was as bottomless as it looked. But we couldn't be sure that anyone attempting that experiment would be able to come back out again.

So we passed by, and then dragged the kayaks over the sand, and so it was that we came to that day's true shore of what maps call Lake Powell, because we have to call it something that anchors this combination of land and water and history to gridlines on a map and to the ever-contentious issue of who gets to manage the particular water that comes to rest in a particular place, but that on that day in late spring looked a hell of a lot more like the wild Colorado River, with the bobbing husks of tumbleweeds rocketed along by a current raging enough to put genuine fear into two guys who had until a moment earlier thought they'd be paddling rather casually across the thing. The lake wasn't a lake anymore, not here; it was a river, and even from our position well downstream of the cutbanks we'd poke along later, we could hear the swirling hiss of its flow punctuated now and again by the always-unexpected booms of erosion, the unpredictable within the predictable.

All this sediment—the sand dunes, the mud pots, the cracked clay banks—had piled up here at river's end when the lake was higher. Now it was exposed, and the renewed current was picking at its edge and moving material further downstream, a continuous conveyor belt.

But time's arrow shivers, shimmies, bends back on itself. The place was wrapped in contradictions. Here we were on a desert river that fed into a diminishing lake, its murky water the product of clear, distant mountain streams. And even though the reservoir had for the past decade and a half primarily been falling, it was rising. For it was late spring, when the snow in those distant mountains of Colorado and Wyoming was melting fast, producing a surge of runoff that swelled

the river's current and far exceeded the volume of water released every day through Glen Canyon Dam. In another month much of this terra seemingly firma could probably be inundated again.

For a while, at least.

The appeal of the desert is that the world's torrent of information is reduced to a trickle. The chirp of a single bird, the hum of a bee, the spread of a tree growing along a wash resonates with meaning because it comes in isolation. And this was true even for a wet riverbank along the desert's biggest river, with the world pared to its simple essentials: driven by gravity, the water acts out its long descent to the sea, while the silt it carries, also invoking gravity, settles out, building new banks and barriers that in their turn change the course of the river.

You can't step in the same river twice, wrote Heraclitus; where the Colorado slows, even the river hardly moves through the same channel year after year, instead reinventing itself in a constant process of destruction and creation.



After we careened downstream past the cutbanks we passed the sand dunes and saw before us, in the middle of the stream, a jagged spit of gray mud. It looked like a low, rocky island: a place where the dissolved muck of the river had somehow coalesced around itself like a new sun forming itself out of interstellar dust.

It was, I thought, some of the newest land on earth, and I wanted in on it. On this heavily used and imperiled planet it was one place on which probably no one had ever set foot: a sort of terra incognita, even if it was only a few dozen square feet in size. And even if it would be submerged again in a few days. It was fresh, and had something of the pristine about it, and maybe if I stood

upon it I could feel just a bit of the frisson of adventure that I was seeking in Powell's footsteps.

Getting there was no problem, as the current carried us straight there. We drifted along fast with small bits of driftwood and inescapable plastic debris: a stray lighter, little bits of Styrofoam, a crushed water bottle. Within a minute we were near the island. I veered toward it and tried to pull myself to its shore with my paddle.

I guess I was hoping for the feel of rock clad in mud. Instead the paddle sank in the way a spoon sinks into a bowl of chocolate pudding. I pushed harder on the paddle: no resistance. The island wasn't rock at all; it was nothing but mud. How deep was it? Deep enough that there was no way to find out without leaving the paddle there for good.

With a jerk, I pulled the paddle out; I'd need it to get home. The new land would have to remain virginal. It wasn't ready for human beings. Our occupation, if it were to come at all, would have to wait a while longer.

And understanding how we are to live in the new places we are creating would take more effort than simply standing triumphantly on a mudflat

So we passed the lumpy island. Beyond it the current softened as the river pooled in the inflow where another tributary canyon came in. Numerous hanks of driftwood floated more or less along a line connecting the canyon's widely separated banks, which here consisted of low cliffs of sandstone. Passing through the driftwood, we entered quieter water: somehow the river's current caused water to pool quietly in the canyon. And so for the first time since we put in we could drift effortlessly and be still.

The canyon looked promising: its flat water extended to the east a ways and then disappeared from our view between rubble cliffs. It promised a different sort of paddling than we'd been

doing on the river. So we headed away from the Colorado's maelstrom, past floating branches and trunks, into a placid pool whose calm was interrupted by the frequent slaps of fish jumping. As we proceeded we noticed the water becoming a little more clear, a little less churned through with countless particles of dissolved muck, and the raw exertion of powering ourselves was a pleasure.

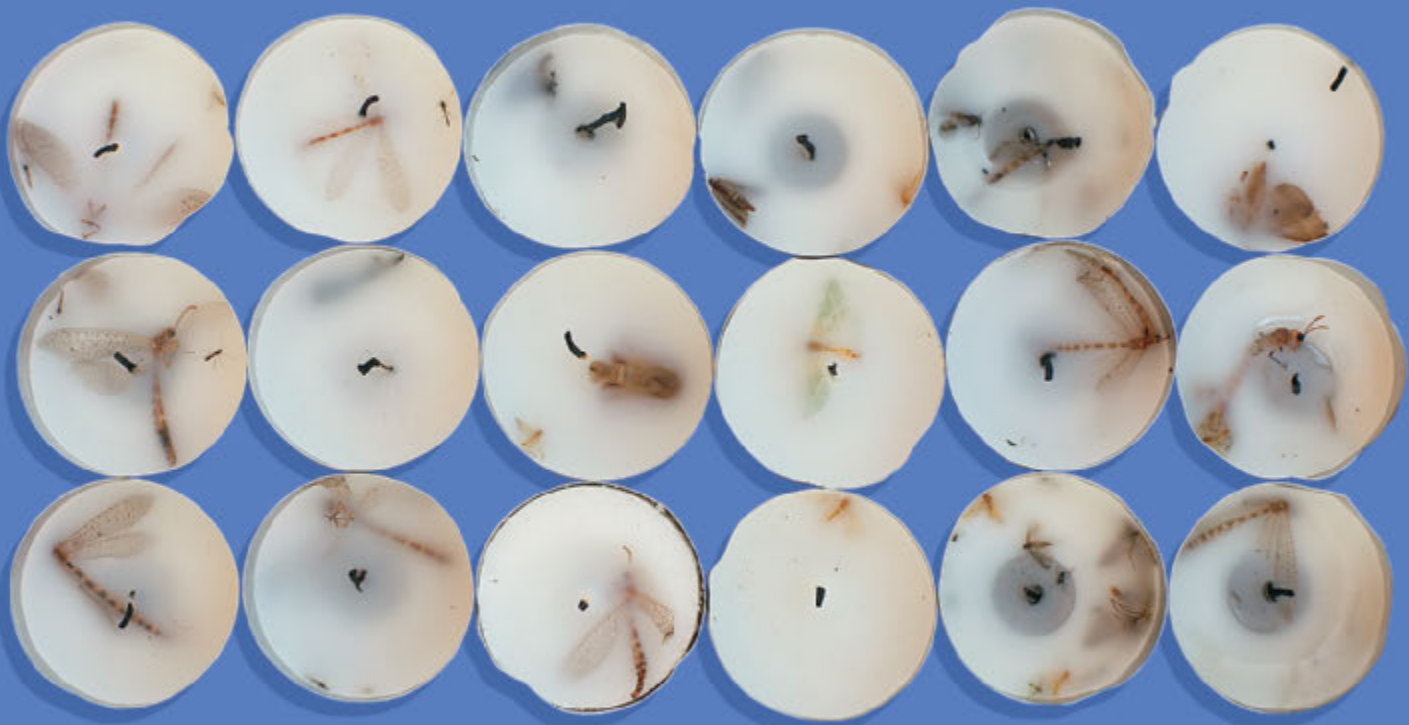
But we could not resist a look back. Spinning my kayak, I took a last look for the day at the Colorado. From my low vantage point, I couldn't see much of it.

But I could spot the mud bar I'd tried to visit, and the pale edge of the low dunes we'd crossed, just in time to see what at first seemed an apparition: semaphore flashes of white in the air just above them. Only by watching for a minute did I understand what I was seeing: a phalanx of ponderous pelicans, white as snow, circling down and settling in for a landing on the river's edge. They were headed north, surely, on some ancient migratory route, and maybe they would somehow be able to find some fish to catch in the muddy river. Or maybe they'd fly into the canyon we were navigating in search of clearer water.

Unless pelicans tell stories to one another as they spiral high on ascending thermals, they surely had no knowledge that this watercourse once held nothing but a spring-brown river, or that people wanted it to be a blue lake: they were creatures of the moment, filled with their desire for food, and for a place to spend the night where they'd be safe from coyotes, and for another piece of their journey completed.

I envied them as much for this simplicity of soul and for the purity of their hunger as for their ability to descend from unseen heights and make the place their own for a short while.

But we had a campsite to seek for the night, and we were hungry, too, and so we spun again to go.





































ROUND RIVER

Some called it a rape.

Others said it was a promising marriage that would bring the water-starved residents of the Southwest a little bit closer to heaven on Earth.

Maybe both were right—for who can ever from the outside really understand what an intimate affair is like?

But of this there is no doubt: the union that resulted in the birth of Lake Powell was a tumultuous one. On the one side, a remote and beautiful wilderness that happened to sport ideal topography. On the other, the engineering acumen of a young country hungry to make its mark. Which in the 1950s may have meant an interest in expansion of its influence abroad, but there was plenty of surplus energy to spend within the borders in the form of bending nature to man's will.

And so: the muddy water was diverted through tunnels, the pale concrete rose, and in the same year that John F. Kennedy was shot, the gates closed and the river died for a time and the lake was born. The winter storms filled the high snowfields of Utah and Wyoming and Colorado as they always had, and in the spring the runoff powered down through the mountain valleys and churned through the canyons and pooled higher and higher in what quickly became America's new playground, a vast and growing democracy of leisure spelled out in motorboats and water skis and the hotels in the new waterside city of Page, Arizona, and the nascent marinas—Wahweap, Bullfrog, Hite, each one a lawn-mowing, asphalt-paved, air-conditioned colonial outpost of gas stations and parking lots and convenience stores in what only recently had

been hostile terrain. The lake spilled across desert flats, snaked into tributary canyons, crept up the massive sandstone walls.

It was a young thing, pristine in its own way, careless of its own growth. Unmarked by signs of age, it, like so many powerful youths, tended to elbow thoughts of the past out of the way—just as the new recreational wonderland erased inconvenient thoughts of the Paiute and Navajo peoples who had once wandered some of the now-drowned canyons.

“Maybe the dam shouldn’t have been built,” the river runner and lake explorer Buzz Belknap reflected to *National Geographic’s* Walter Meayers Edwards in 1966, “but it’s mighty hard to mourn Glen Canyon now that I’ve seen Lake Powell.”

Indeed it was easy to love the new: there were those fresh expanses of cool water, and once-hidden canyons to explore, and the swelling feeling of more to come. For most of those who came to visit this new recreational mecca, anyway, it was as strange to contemplate the time before the reservoir’s creation as it is to imagine life before one’s own birth: something must have been happening here then, yes, but it was so confounding to really try to understand what it was like that it was easier—safer perhaps—to pretend it never did. A rising reservoir is a tool of forgetting, wiping out the signs of what it destroys below, each stepping-up of the water level a new status quo and another opportunity for yet more growth.

As the Arizona poet Richard Shelton put it in his elegy to Glen Canyon:

we will move over the water
with such speed we will forget
even what we have never known

Speed, technology, and a willful disavowal of anything complex from its own past: Lake Powell, in other words, was the perfect simulacrum of America in the go-go postwar years.

And for about the time it takes one of us to reach adulthood it grew steadily bigger. Not until 1980 did it finally grow to its full potential, when its surface area had spread to more than 250 square miles of water lapping against a canyon-convoluted shore that, were one able to stretch it out in a straight line, would exceed the length of the Pacific coastline from Mexico to British Columbia.

And it was useful, holding about 8 trillion gallons of water, or something like twice the amount that flowed down the river in an average year, and doling it out according to need, with the added bonus of producing through all the gravity that water carried enough electricity to light up or cool tens of thousands of houses in the swelling boom cities of the greater Southwest. It was a neat and efficient trick: families could spend their vacation on Powell, catching striped bass and sunburns, and then head home to a tract house where the refrigerator and television ran on the very same liquid.



Like any youth the new lake had potential, and even a capacity for danger, beyond what its parents could foresee or control: “more gifts that its conqueror is capable of comprehending,” wrote Edwards in his adulatory article. Within a few years of its filling, in 1983, the lake was dangerously high, filled to its brim by heavy snows that had fallen in the Rockies during an El Niño winter. When the Bureau of Reclamation’s engineers tried to relieve the pressure by opening the spillways, the water shot through with such force that it carried with it great chunks of Navajo sandstone—the dam’s very foundation.

The dam shuddered. The lake was grown to a Frankenstein, one whose untested powers might soon burst the bounds put upon it by its creators.

The engineers had to cut back the outflows. They mounted sheets of plywood on the rim of the gates protecting the spillways so that the reservoir could rise still higher. It worked. By July 15 Lake Powell finally peaked at only seven feet below the rim of the dam.

The spillways needed repair, and the magnitude of releases from the dam had raised havoc on the river runners who'd been dealing with high water in the Grand Canyon below. But the dam was safe, and the engineers had learned their lesson. You might say that was the day Lake Powell reached adulthood: a fullness, and a stasis. Call it regularity. Or use the term water managers coined to mean that their output and their jobs would be predictable, whether in wet years or dry: stationarity. From that point on, the dam's managers would no longer allow the reservoir to rise quite so high. And so it settled into its maturity, rising with the wet years, sinking in times of drought so that a white cast of minerals—the so-called bathtub ring—formed on what once had been redrock cliffs. Rise and fall, rise and fall—this was the quotidian life of a working reservoir in the modern American West. The lake expanded in spring and summer with the mountain runoff, sank in fall and winter as its water slowly drained through the dam and into Lake Mead, and all throughout it provided a watery playground for the masses from Phoenix and Salt Lake and beyond who came to boat and fish and camp on the azure waters.

The future had arrived. Whether you saw Lake Powell as a shining success, or as an abomination that never should have been born, you couldn't deny the sheer actuality of its presence.



The Hopi say that rivers form a circle only half of which is readily seen. Yes, they flow down from the mountains and toward the sea, but what we easily overlook is how rivers flow *back* in the air that conveys rain and snow from the distant ocean: an endless cycle that from the perspective of a people that has been able to live for a millennium and more on dry Arizona mesas is fueled as much by proper behavior and mindful prayer as it is by physical processes.

Leave the prayer and the humility aside for now. Take a look at the physics. As Lake Powell did its job we were busy polluting the air above it with the unseen effluvium from our myriad cars and factories and power plants, raising its concentration of carbon dioxide from about 315 parts per million as Glen Canyon Dam's construction began to 370 parts per million in 2000 and to about 400 parts per million now.

It seems so slight a difference: an invisible story about an odorless and harmless and perfectly natural gas that ought to be of interest only to the geochemists. But the carbon dioxide traps heat and the increase since the industrial era began has been enough to raise global temperatures by about a couple of degrees Fahrenheit.

Which also seems a trivial amount: when you're broiling in the sun in Page, Arizona, on a July day, with the outside temperature bumping up to that of the inside of your body, and then the mercury climbs up by another two degrees, it scarcely matters to your comfort level—and anyway there's a lake to jump into, and all the air-conditioned diners and stores catering to the tourists who haven't yet made it to the shore.

But here is why it does matter. Every molecule of water that falls from the air is subject to the push and pull of two countervailing forces. There's gravity, which seeks to pull the water down through arroyo and creek and canyon—or maybe through hidden aquifers—until it finally reaches

the sea again. And there's evapotranspiration, or the tendency of liquid water to disappear from plants and soils by becoming a gas.

Lake Powell feeds on gravity, taking its force in through the Colorado and its tributaries, pulsing it out in organized and efficient fashion through the dam. But when you try to corral water in a dry place the shimmering dance between gravity and evaporation becomes a war. During an average summer an estimated half a million acre-feet of water—163 billion gallons—steams off the reservoir's shining surface into the thirsty desert air. Bump up the average temperature by a couple of degrees, and you increase the rate of evaporation, and the loss of water.

But in the big picture the water coming off the lake itself is not the big worry. Here is what matters far more: evaporation takes place throughout the Colorado River's watershed. Increase the temperature, and you don't lose more water only from the surface of lakes and rivers: you lose it from every plant and from every square inch of moist soil. Even a small increase in the evapotranspiration rate translates into a big difference in runoff. When two scientists ran the numbers to assess the future of the Colorado River basin, they calculated that a 2 percent increase in evapotranspiration causes a 14 percent drop in runoff.

You can see the problem. Even if nothing else were changing, the raw increase in temperature that is the inevitable result of global climate change means that less water is available to run into the river, and into its reservoirs. By 2050, climate models predict, the Southwest is going to be 2.5 to 3.5 degrees hotter than it is today. There is so much inertia built into the atmosphere-climate system that much of this warming will take place even if societies worldwide make dramatic infrastructure changes, and soon, to reduce greenhouse gas emissions.

Even if nothing else were changing. But at least as important in determining runoff rates as evapotranspiration is the amount of water falling from the sky. In general, climate models suggest that low-latitude areas, including many of the world's deserts, are likely to receive even less precipitation as altered atmospheric temperatures alter storm patterns. Areas farther north and south are likely to become wetter. The mountains that feed the Colorado are more or less in the middle. Will the overall amount of rain or snow they see change? Probably. According to a study that looked at precipitation patterns in the southwest United States since 1979, the weather patterns that bring rain and snow to the region—low-pressure systems that convey Pacific moisture inland—have already become less common. It's a pattern that is very much in line with what climate models predict for the future. And here, too, increased temperatures—which are a clear and undisputed effect of global climate change—make a difference. Whether precipitation falls as rain or snow matters. Mountain snowfall is the great holding basin for water in the arid West—the reservoirs' reservoir. If more of the same amount of overall precipitation falls as rain, plants can more quickly use the water. They intercept it before it can run into streams—and again, overall runoff suffers.

For each 1 percent decline in precipitation in the Colorado River basin, the river conveys 1 to 2 percent less water. For every degree of temperature rise, the river loses between 3 and 6 percent of its flow—maybe more, depending on who's doing the projection. By the end of this century, the new normal condition of the Southwest, according to an analysis of nineteen different climate models, will be a dryness akin to that which prevailed in the 1930s and 1950s—two periods in which agriculture in much of the western United States was ravaged, even as overall demands for water were much lighter than today.

Even if nothing else were changing. But in recent decades the West has become a dustier place as livestock grazing, roadbuilding, construction, and recreation degrade soils. As a result, gusty spring storms carry increased amounts of dust to high mountain snowfields—and as that dust absorbs sunlight it causes the snow to evaporate or melt more quickly, causing the same cascade of gravity-defying effects. According to the U.S. Geological Survey, the increase in so-called dust-on-snow events documented in western mountains between the early twentieth and early twenty-first centuries has likely caused a 5 percent drop in runoff to the Colorado River. More future dryness is likely to mean more dust, faster melting, less runoff.

Even if nothing else were changing. But when water from streams and rivers isn't available for farms, or for towns and cities—or when more people end up living in parts of the West, as continues to happen—groundwater takes up the slack. Drill a well, slake your thirst. But groundwater levels can drop, and aquifers are connected to surface waterways. In the ten years preceding 2014 an amount of groundwater roughly equivalent to all of Lake Powell, filled, was sucked out of the Colorado River's upper basin—the part that feeds Lake Powell. That means less of a buffer for human communities. It means springs dry up. It means less subsurface runoff available for the river.

Put those figures together, even the most conservative ones, and it's no wonder that one research group calculated that there is at least a one-in-four chance that Lake Powell and Lake Mead will within decades be at levels too low to allow any generation of electricity. Other projections have suggested that this condition, known as "dead pool," could come very soon—even within this decade. And Lake Powell is more threatened than Lake Mead. As water managers decide how to allocate water between these two once-giant reservoirs, they can't ignore the fact that the latter reservoir directly supplies drinking water to Las Vegas, while Lake Powell furnishes

municipal supplies only to the much tinier community of Page. From the perspective of human utility, Lake Powell is the checking account that can fluctuate. Lake Mead is the savings account, and when its principal declines the effects are going to have wide repercussions.

In the summer of 2015 Lake Mead was at its lowest level since the Dust Bowl. Workers were busy building a new water intake for Las Vegas, at the cost of more than \$800 million, to ensure that the city can keep drawing water from the very bottom of the reservoir even if its water level drops low enough to idle Hoover Dam.

Increased temperatures. Diminished mountain snowpacks. More dust. Faster runoff. A longer growing season. More human pressure on all sorts of water sources. Taken together, all these changes tell us that the Colorado River is “dammed at the source,” as Bill McKibben presciently put it in his 1989 book *The End of Nature*. Every mountain vale and arroyo and hillside feeds just a little bit less runoff into what lies below.

If that Hopi conception is too abstract, think instead of Glen Canyon Dam and Lake Powell, together, as an enormous and finely tuned machine. The engineers learned how to operate it, but now the conditions it was designed for have changed. The dam itself is fine, but the entire system is reaching what looks alarmingly like a sclerotic old age, with its longevity or at least its ability to be a contributing member of society in doubt.

And even the more dire warnings placed between the covers of sober government reports seem to suggest that the climate behaves in a linear, somewhat predictable way, as if it were akin in some way to all those engineers wielding slide rules who built the dam. What if the new human-altered climate is really out of the box we’ve grown used to, subject to not only known unknowns but also unknown unknowns? The atmosphere’s growing heat shifts the baseline toward

aridity, so when drought comes to the Southwest it is going to be worse than it would have been without the raised temperatures. The climate models that were used to craft the 2014 National Climate Assessment suggest that, if emission levels don't change, there is a 50 percent chance of a ten-year "megadrought"—the kind of grinding, multiyear arid spell that totally reshaped native civilizations in the Southwest during the twelfth century. A more recent model calculates that risk at more like 80 or 90 percent. And in the second half of this century there's also a significant chance of a much longer, severe drought that would be worse than anything humans in the region have experienced since the time of Christ. As the authors of a recent study that paired many climate models with analysis of the paleoecological record put it: "the mean state of drought in the late 21st century over the Central Plains and Southwest will likely exceed even the most severe megadrought periods of the Medieval era in both high and moderate future emissions scenarios, representing an unprecedented fundamental climate shift with respect to the last millennium"—strong wording for those writing in the sober language of science. Such a long-term dry spell might not quite turn Phoenix into a ghost town, as some writers have speculated, but it would at the very least devastate and depopulate rural areas and spell the end to the long tradition of arid-lands agriculture in Arizona and southern California that has placed reliably cheap vegetables on American tables all winter long.

Finally, weirdly, there is this: with higher temperatures, the atmosphere can carry more water. One of the effects of climate change—not just in the Southwest but everywhere—is a greater frequency and intensity of extreme weather. So even if the new, changed atmosphere over the Southwest is firmly pressing down on one side of the scale, even if it is almost certain to become much, much more arid—there is still the chance of oddball events like the 1983 El Niño that so

shook Glen Canyon Dam and the Bureau of Reclamation. In the face of a drying region, there is still some chance of massive floods that might fill much even of a reservoir as large as Lake Powell.

In 2008 a group of hydrologists and climatologists published a paper in *Science* claiming that, as their title warned, “stationarity is dead.” They meant the notion that climate was once broadly reliable. Even in dry regions water planners could once rely on broad multiyear averages of precipitation, making possible the construction of dams, reservoirs, canals, and other aspects of water delivery infrastructure. No longer. In a world of climate change and uncertain precipitation, here is what we know for certain: the rules that have governed water supply since John Wesley Powell’s day are no longer a trustworthy map for the terrain ahead.

We’ve had enough trouble coming to terms with the highly visible concrete dams that plug the river, their stolid presence. How then are we going to comprehend an absence instead: that the river’s source is so widely and so invisibly blocked?



Hite is the little marina and National Park Service enclave way up in Utah where the Colorado River slowed and Lake Powell began. No: scratch that. It was.

1999: From the roadside pullout high on the cliffs above, the sparkling blue water is alive with boats, a tourist brochure come to life. The lake is brimful: no bathtub ring mars the rocks. The little settlement below hums with activity. Big SUVs back down the ramp to launch speedboats equipped with giant outboards. Families emerge from a little store laden with sodas, bags of ice, bait. Up at the overlook, an interpretive sign tells the story of Cass Hite, an early gold miner in this

country. He left behind his name, but little else. No wonder: he was looking in the wrong place. The riches to be found here, it's clear, were not buried in the ground, but rather to be extracted from the desert's real treasure—its water.

2004: The blue water is gone, dozens of vertical feet of it seemingly evaporated into the hot air. In its place, much lower and narrower, a chocolate-brown river runs between cracked mud flats. A lone genera or runs somewhere, but the traffic is gone, the store and ranger station shuttered. Ridges and swales of sand and clay have pooled in parallel series, making the roads and buildings seem an afterthought, hopeless as shaking a fist at the dry desert wind: it is a wilderness of sediment, crinkled and fractured, reminiscent of the pile of gunk left in a driveway after a really dirty car has been washed. Long cement ramps slope down from the buildings toward the river, turning into gravel and then into dried mud in a drawn-out and finally hopeless pursuit of boat-launching opportunities. Up here, on the rim of the interpretive sign, someone has pasted a bumper sticker: "Free the Colorado." The years of what look like drought have been a boon for those who have always hated the dam and what it stands for, returning dried-up stretches of once-drowned tributaries to something of the sandstone grandeur that they'd once had.

Next to the bumper sticker someone has scrawled, in jagged black pen strokes, "Will the last person to leave please turn the Hite out?"

2014: Desolation is the new normal, at least if you are measuring according to what we once thought of as the typical give-and-take of a reservoir. Lake Powell has experienced a lot more taking than giving, and the water has not returned to Hite. From above many of the mud flats look green with tamarisk and tumbleweed. But the lake is a fading memory. And it becomes increasingly hard to remember what the place looked like when the water was higher. Stand on a canyon

rim, and even though you know that the water below has through eons carved out the cubic miles of rock that are now filled with air, it is a big leap to imagine the land the way it once was. Same with the many dozens of vertical feet and trillions of gallons of Lake Powell that have evanesced into sky: even where their passage is marked with the chalky white of the bathtub ring, the mind's eye has trouble painting deep still water on the scene.

This is a landscape of grief, in other words, where the heart's desire to remember with precision what the place was like—whether that means for you the predam canyon, or the sparkling lake—collides with the brain's trickling loss of memory. It will not be the same place again, and we cannot remember our way back to just how it was. Grabbing onto the way it was is like grasping for lost youth, a quest as pathetic as it is doomed. Sure, the geographical coordinates may be the same. But what is at Hite now is neither old river nor not-so-old lake. It is a new sort of place, one that poses new questions for us.

The most immediate is: is this what the future looks like for us, not just on the once-shore of a once-lake but throughout the arid West and so many other arid places worldwide—a cracked and blighted desolation, dirt gathered under unwashed fingernails, tumbleweeds clogging the irrigation canals, hordes of modern-day Okies fleeing a new Dust Bowl and facing an uncertain welcome in what they hope will be wetter climes?

There is a fair chance of that. And so a prudent society, in the face of impending shortages, might decide that the population in its most arid regions should at a minimum not grow any more. Maybe it should even shrink to accommodate the great likelihood of future shortages.

Between 2000 and 2015 Arizona's population grew by well over a million people—more than 25 percent. The Arizona Department of Water Resources, expecting continued population growth,

predicts that the water demands of the state's residents will grow by another 20 to 25 percent within the next twenty years.

The rivers of New Mexico and Arizona that complement the Colorado's water are expected to suffer more heavily from climate change than the Colorado itself.

The job of the engineers and the politicians and the bureaucrats is not going to be enviable: figuring out how to get water to the places that need it, or whose people are most willing to pay for it. Figuring out whose taps to shut off.

And the job for the rest of us everywhere is also a challenge: figuring out how to reimagine this place, and every place.























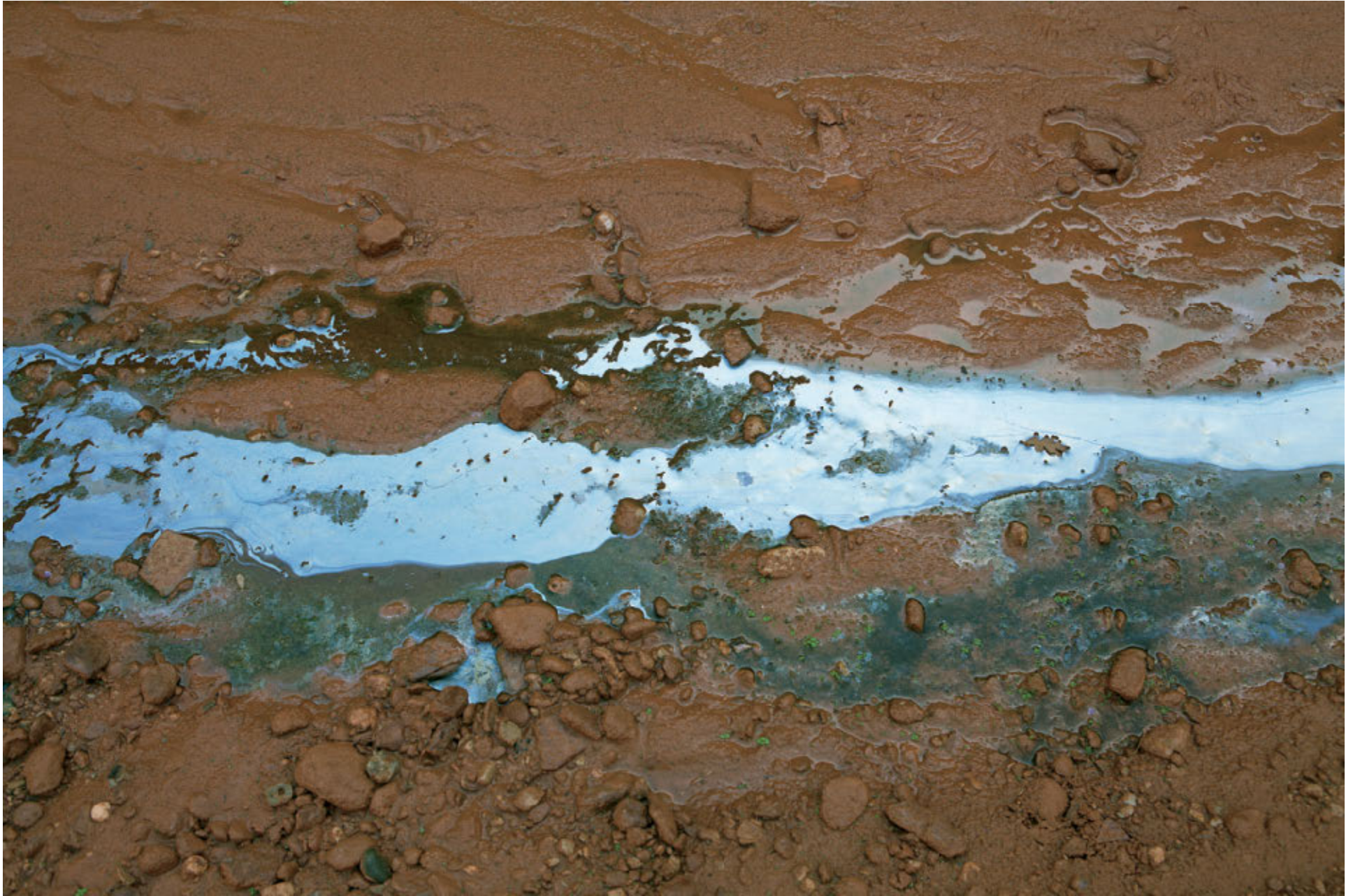


























THE UNCHARTED

What are we supposed to do with our knowledge that we live at the end of nature, that the driver of the Earth's powerful cycles has become us as much as it is the other thing?

We have to grieve, of course. And celebrate.

Celebrate is easy for me to say because it is hard to feel bad when you are messing around on a small boat, even when that boat is spinning around in murky and uncertain currents under a too-bright overcast sky on what might fairly be termed the embodiment of the biggest slow-motion disaster that has ever faced humanity. We might celebrate because that is what we do when we mourn a loved one, or even when we mourn a part of our own past that is gone: because grief alone amounts to despair, and takes on resonance and meaning only when it is fused with the joy of what has gone and the joy of what we can carry with us from the past. We might celebrate simply because we are alive and are all collectively entering a sort of place—or many places—that John Wesley Powell would have recognized well: uncharted terrain.

To know not: we've got that covered now, for better or worse.

Let us put aside for now the worry about where the water is going to come from, even if that is one of the things we really do not well know. Thirst is a powerful driver. As the Colorado River dries—and not just the Colorado, but numerous other arid-lands rivers in the western United States and around the world—people will find water, whether through conservation and wise use or through violence and unwanted migration. Maybe the green lawns of Phoenix really

will go away at last, or the lettuce fields of Yuma. How that will happen is a question of critical importance that I am not going to answer here. My concern is broader: how do we reimagine a landscape—every landscape—that is changing to something new?

It was a thought much on my mind as we paddled up the side canyon and away from the river: about three miles, an easy glide across slack water, and we camped that night on a comfortable sandy beach below broken cliffs whose white pallor showed exactly how much water had withdrawn. How dark would it have been here under seventy feet of water, I wondered. Would there have been any glimmer, or even a memory of what light had looked like on the surface? There is always something a bit creepy about exploring what was once buried so deep: Lake Powell's withdrawal exposes sunken boats, and the detritus of camping and fishing, and always I have the uneasy thought that there must be long-sunken bodies lying around somewhere too.

Maybe not here. It was a sweet camping spot. The night was calm. The moon rose. Coyotes howled. Maybe they fed on the fish that kept jumping and landing back in the water with vigorous, always startling slapping sounds. The beach was littered with copious driftwood, so even though the night was warm we did what people do: we built a fire. As the night gathered round we stared into the flames, tired from the day's workout, and did what people have always done, the same thing we'd do in a little while lying under the stars: let the hypnotizing patterns take us out of time itself.



But of course we had to come back from there. In the morning we packed up and paddled out of the canyon to the low rocky point where its slack water met the living water of the river. We pulled over to have a look, uncertain what the current was going to be like.

It looked strong, as the debris it was carrying was cruising by at breakneck pace. But just downstream the river curved away from us into a great embayment, a wide expanse where the canyon walls on either side bent far away from each other, leaving a large pool. We were curious what would happen if we rode the current's express train downstream: would we be able to come back? So we watched as the driftwood branches tore by and curved along the bank and continued and then, far enough from us that we could only make this out through binoculars, came to what looked like a stop, bobbing in the brown water.

We'd found the place where the current stopped—or at least we could see it from here. With a gathering sense of excitement we crammed ourselves into the kayaks again and paddled pell-mell into the current.

It was an exhilarating ride, even if because the canyon was so much wider the sense of speed was less than yesterday when we'd been so close to the bank—and here there was no danger of the sides of the river caving in on us. On this open water we could have the illusion that we were remaining still while the great world spun and curved around us: the low rubble banks and beyond that on one side a ragged set of cliffs that must have been well over a thousand feet high, and on the other side the high cones of mountains that still held high up traces of the winter's snow.

A wild place that here was reborn in the form of the river bearing us along: maybe it would be hard to come back upstream as we'd have to do, picking our way along the bank—but surely this rush of a ride was worth it.



Here is another reason why we might celebrate our new status as cocreators of the places we live and visit: it would be a way of acknowledging a truth that we have tried to shirk. Too often when we use the word *nature* we employ it as a sort of armor to protect ourselves from blame. Natural disasters come with no blame, no guilt. They *just happen*: because of the black-box workings of weather, geology, God. Studies have shown that people feel less panic and dismay about natural disasters than about human-caused ones. Somehow the lack of mindful causality behind a fire or flood removes all those difficult questions of guilt. Despite Job's travails, "why me, God?" remains an easier question to deal with than "why me, neighbor?" or, worse, "why me?"

Nature has been an easy out.

Let's say that previous droughts that slammed the American West—like that of the 1890s that killed millions of head of cattle and spelled the end of the open range, or that of the Dust Bowl—were natural events. Many of their effects on particular places were the result of particular, often unwise, land uses, but the raw fact of dryness itself, the aching failure of the sky to deliver moisture year after year, we might call natural. Calamitous, yes, but lacking an ethical edge.

The current drought that has caused so much of Lake Powell to vanish into clear air is in a different category. It is nature intertwined as thoroughly with human agency as the main stem of the Colorado River merged imperceptibly with its myriad tributaries as the reservoir filled, forming a single whole on which you could sometimes no longer tell just where the river had flowed. And so we have to wrestle with the knowledge that we are not only in a tough spot where practical action is needed, but that we have to understand our own complicity.

We have fought against nature for so long, spent so much energy and ingenuity in trying to run the show as gods. Now we have succeeded, only to find that the job is so much less clear-cut

than we'd thought, more a tangled web of Olympian intrigue than an easy monotheistic exercise in omnipotence.

But this mess is our new terrain. This is our new task.

I do not wish to diminish the seriousness of the job before us in dealing with a drier West, or a melting Arctic, or eroding coastlines. I do not want to gloss over the innumerable and inevitable casualties that are going to accompany the too-fast changing conditions of our planet. But I do want to point out that much of what fueled the Powell expedition's almost manic dash down through the canyons of the Colorado was a mingled sense of mystery and destiny: the conviction that it was only by embracing a dangerous unknown that a fledgling country could grow into what it surely ought to be.



As we moved farther downstream into the massive natural amphitheater, Tim and I were finding it hard to get much perspective from only two feet above the water. Distances deceived, scale was impossible to measure. At one point we were convinced that traveling down the current with us was a jumbled island made up of a few tangled root masses woven together like the world's unti-diest duck blind—it sure looked to be moving in front of the desert backdrop. But then we passed it and saw that all the wood seemed to be anchored to a raw mud island like the one I'd wanted to step ashore on the day before.

I think so, anyway. As I think back on it I'm still not sure it was not moving, like those flood ripped floating islands you read about on which landlocked animals and plants have crossed entire oceans.

Far ahead of us we could see what looked like a flat rocky shore. But the color was wrong: around here the sandstone was, depending on its elevation and whether it had been inundated or not, either a burnt red or a dirty white. This shoreline was brown, and the depthless black forms of vultures perched on it.

And it seemed to be moving.

We, on the other hand, were slowing down. The current still carried us along, but more slowly.

I looked ahead with the binoculars. What looked like a shore was not: it was a raft, made up of innumerable pieces of floating driftwood. It was a giant logjam that must have covered acres. This was the true end of the Colorado, for now, the place where the current died and dropped its load. And as the sediment spiraled down the driftwood floated lazily, waiting to see where it would be pushed by the wind.

We could hear a new sound, too. The constant susurrations of the fast current were fading away, replaced by something more rhythmic, soothing as a heartbeat. It took us a while to figure out what we were hearing.

"It's waves," Tim said, finally, and he was right: we had been so used to the feel and sound of a river that it was a surprise and benediction to hear how the upcanyon wind was pushing a chop against the shore in this, Lake Powell's uppermost bay. We had arrived. But where were we?



In any time frame meaningful to people alive today, Glen Canyon will not house a mountain-fed stream running through a pristine canyon.

Nor will it be managed purely by human intention as the construction of Glen Canyon Dam was.

Rather, Lake Powell's water level will be governed by a murky combination of human and natural factors. In a warming climate, it is likely that the higher reaches of Glen Canyon's side canyons will not be submerged much, if at all. They are likely to recover and remain as examples of what the entire canyon region once looked like. Backpackers will be happy with that: there will be glens and coves, shadowed stream reaches, perhaps recovered groves of cottonwood.

Barring some sort of political shift that is scarcely imaginable at this time, the reservoir's lower reaches are likely to remain submerged for a long time. Even if Lake Powell is arguably less important for the Southwest's overall water infrastructure than Lake Mead, it remains politically important as a way for the Upper Basin states to retain a claim on the Colorado's water. An era of perennial scarcity, and of extreme political polarization, is unlikely to engender the sort of political goodwill that would allow the states higher up in the watershed to forsake a reservoir they fought hard to create.

And between water and land, the place that we have called Lake Powell is likely to constitute a huge in-between zone in flux between water and land. Much of Glen Canyon is likely to be, for the foreseeable future, a place *between*: between flood and drought, water and land, human and natural. It will be a liminal place, constantly in the process of becoming—whether what's being created is water or land.

It will be a place of mud and sand and swept-away roots, a place where the scent of decay might just carry a waft of freshness about it, like a volcanic field that reminds us of the intricate ever-locking dance between destruction and creation.

That ambiguity will be hard for many of us—whether water managers, tourism advocates, or rank visitors—to deal with. In purely practical terms, it's hard to manage a place that unpredictable:

where will the boat ramps go, and the campsites? Should visitors plan to boat, or to hike? How will they get through the mud flats

The canyon country has for a long time been one of the purest examples of the human-nature divide that characterizes much modern American understanding of our surroundings: the wild river subject only to itself, the tame reservoir locked up by engineers. Whether you believe that Glen Canyon Dam degraded or improved its setting, the two forces have almost always been viewed as distinctly twain.

The result is the logjam we've seen in our political system, a grinding paralysis that has made it almost impossible to do anything meaningful about the climate change problem.

Maybe what we need instead is the ambiguity that is the new Lake Powell. Maybe the fact that so many places need to be reinvented will enable us to break out of the old forms and make a new start.

The Hopi farmers who live on arid mesas not far from the Colorado say they have been experiencing the effects of climate change in striking parallel with the predictions of climate scientists. Less snow falls in winter to soak into the ground. The growing season is longer, the spring winds worse. And when rain comes in summer it is less likely than before to come softly. Instead it comes in torrents that erode the fields and run away in the arroyos without nourishing the roots. The same amount of water might fall, on average, but still the farming is harder. This is known; this is seen.

And the Hopi know why. Yes, they have heard what the scientists say about fossil fuel emissions and the greenhouse effect. But the real reason for climate change? It begins, not ends, with human behavior. The climate is changing, according to the Hopi, because of a failure of prayer, of

humility. That is the ultimate reason for the physical changes. And just as the river we see on the ground and the unseen river flowing upstream in the atmosphere above us form a single unbreakable whole, the torn bond that has sundered prayer from precipitation cannot be made whole again without a proper attitude.

Maybe what we need to do, then, is to embrace this new ambiguity, to accept that we are as gods but far from omnipotent, that we are rather cocreators, that we are as much nature as what we once labeled as nature because it seemed outside ourselves, but that with this new promotion comes new responsibility that might truly be labeled what has become one of the most clichéd words in American English: *awesome*.

It cannot be downplayed that this acceptance of our new role will be at least as hard as the task that faces the water managers in the face of diminishment. It will be akin to the drawing back that young people face as they embrace adulthood, a recognition that the unbridled use of new powers without responsibility results only in disaster.

Some people never manage that. And maybe some societies never manage that. But never is not an option anymore.

Doing so will be a matter of finding poetry in a new mud flat where speedboats once raced—or in the muddy, debris-filled broth caught in the branches of drowned cottonwood trees after a wet winter. There will not be much easy majesty to our way of seeing. Maybe the light will be flat, the shorelines barren, the red rock stained white. Lake Powell has already been a good place to practice this sort of sight, with its innumerable rockbound coves that in the stark light of noon appear lifeless and abandoned, as if some calamity had already swept away most of life. We will have to gain a layered appreciation of complexity, and of flux. And of our own limitations.

I don't have a good recommendation for precisely how to do that, but I am fairly certain that getting out into the mud—into some mud, somewhere—is a necessary step.



We drifted along, moving now not with the current but with the wind. On one side, far off, the endless driftwood branches were jostling one another, moved either by residual currents coming up from below or by the same breeze we were feeling, which knocked little waves onto the shore on our other side. That shore, about a half mile away, looked like a good place to have lunch—a better place anyway than the eerie shifting raft of logs.

Spinning gently in this great bowl of sky and rock and water, we looked upstream at the places we'd come from. The entrance to the side canyon where we'd camped had vanished not because of any topography but due to the sheer weird perspective of being so low to the water; the low rock walls and mud islands shimmered and appeared half hidden by mist and ultimately we couldn't tell anymore what was what.

What we knew was that it would be a tough paddle back up there, against what would this time be an ever-increasing current.

When we did we would at least have our soreness to take with us, the bodily recollection of having worked hard.

I tried to imprint the place on my brain, wondering whether I would ever be back again, or could ever come back again, wondering if—if I do make it back there—I would recognize it. I wanted to make it more than a pale memory to remember later from home. What would we be left with?

Ultimately, nothing. Or nothing tangible anyway: we'd be left with the light itself. With the tool of seeing.

That light—strong and willful enough to be its own being: the washed-out full-body blast of noon when we remember that it is a near relative of fire, the liquid music of rippled sunlight echoing up onto shadowed canyon walls on a hot afternoon, the lambent depth of evening, or the cold ivory and black of moonlight and moonshadow. The ungraspable light, whether fixed on paper or rising unbidden in dreams or imprinted in the patterns of aging on the skin—for now we would have to content ourselves with that as a means of hanging on to this landscape of change, its ever-changing valence as sun and moon paint the rock walls and water's surface the only constant we can rely on.









PHOTOGRAPHER'S NOTE

by Peter Goin

NOTHING LASTS FOREVER

My travels to Lake Powell began in 1987, only seven years after the first full pond.

The bloodred mercury in the thermometer read more than 115 degrees Fahrenheit. The intruding preeminence of light absorbed every molecule of being; only persistent perspiration shielded me from desiccation, from the lifelessness of the absence of moisture. Heat, hot everywhere—yet a ribbon of blueness existed at the edge of the distant horizon, promising salvation. The sandstone walls rise in transcendent symbolism as if prophets were challenging all of us there to ignore destiny: *Take heed, all you boaters, for the drunkenness and waste will deliver you unto dryness.*

Lake Powell's sandstone cupolas and minarets shimmering in a mirage aura appear like nature's cathedrals, constructed so many eons ago by water flowing, by water rushing, by water eroding. So many of the world's religions originated within aridity; these are hardscrabble, demanding, and profound landscapes. Adapt, or abandon hope. The mind's eye wanders among the mirage's layers so far off in the distance.

But there was work to be done: gear had to be loaded, the boat launched, sites scouted. My assistant and I loaded the wheelbarrows with sleeping bags, coolers, stove, camera gear, and

food and ice (yes, indeed, lots of ice) and pulled and yanked these seemingly prehistoric machines up and down the ramp, trip after trip.

Nature's performance for us had only just begun. Within moments, or so it seemed, the sky darkened and sinister lightning flashes bolted from sky to earth. Catastrophe awaited as the storm burst upon the landscape. Each pellet of water slammed into the sand creating small explosions of dust and then puddles that soon evaporated, leaving behind a sticky and consuming air that made breathing deep and unfulfilling. Sweat soaked our shirts and stung our eyes, and we shed tears, without speaking. Thirst became our identity. We were initiated into the atmosphere.

Over the next ten days, we responded with piety and respect, rites and ceremonies, acceptance and determination. We were possessed by the experience of the lyrical; little else seemed possible in that sensory overload.

And so my journey began. Within the long days of light during the summer months just prior to the solstice, I knew that for me the documentary photograph cannot be defined by the literal, by the verifiable, or by the ancestral "operators" (as photographers were called in the nineteenth century) who preceded me. The voices and imaginary narratives—the artifacts—are arrested, reflecting one of the essential characteristics of the made image. The view in the mind's eye is magical and cannot be contained. What truth light provokes is a subtle flow of losing track of parceled time, watching the evening's sky sparkle in resplendent glory, and experiencing the moment as if past and future were philosophical ideals. The wind swirls in fanciful dances, demanding as partners the detritus of plants from far away. Leaves from trees that are not there join the chorus of physical parades, around and around in a timeless thought.

And, then, of course, it was time to make dinner before dark.

I've traveled Glen Canyon and Lake Powell for more than twenty-five years, first from Hite then Bullfrog, Dangling Rope, and Wahweap; I've driven roads from Page to Glendale and Kanab to Cedar City, from Winslow to Hurricane. I've photographed repeatedly throughout the canyons and byways within the Escalante River corridor. Hite, the northernmost marina adjacent to the confluence of the Dirty Devil River and the Colorado River, is more isolated and no longer provides boating services due to consistently low water. I've made no fewer than fifteen research trips, the last five times with the University of Nevada, Reno's photographic research vessel, a seventeen-foot aluminum boat outfitted for photography. I've experienced fear and doubt, joy and sadness, light and darkness within the sublime landscape of Lake Powell. I've been enveloped in waters both warm and cool, and sat in contemplation during the tentative break of early morning's light. The controversy over the lake's origin and destiny makes me wonder about my role in a complex dependency as I appreciate the undulating rhythms of blending colors: sky, sandstone, serene sunlight reflected and energized by canyon walls, and the gentle gaze of life itself.

VISUAL LIMNOLOGY AND PHOTOGRAPHY

Limnology is the study of inland waters, either freshwater or saline, including but not limited to lakes, reservoirs, rivers, streams, and groundwater. The discipline of limnology interprets ecological systems that interact with their drainage basins and the atmosphere. The word limnology is derived from the Greek *limne*, which means marsh or pond, and the Latin *limnaea*, which means pertaining to—therefore, this is the study of the integrated relationships within and among bodies

of water. Limnology encompasses the study of physical, chemical, and biological components of inland aquatic ecosystems, ranging from movement of water and biogeochemical changes to exchanges with the atmosphere.

The trade group for limnologists is the Association for the Sciences of Limnology and Oceanography. Principally, this organization focuses on the science of limnology, but I have upon occasion introduced myself, to raised eyebrows, as a visual limnologist. Practically speaking, every scientific discipline employs photography in one way or another. Introducing contemporary concepts of beauty, syntactic strategies of poetry, and metaphors and symbols within the visual language of photography will one day become commonplace within scientific inquiry.

The parallel universe of a lyrical photographic investigation lying alongside prevailing standards of the objective document is reflected in part by Walker Evans's definition of the documentary photograph as "deliberately wrought visual poetry disguised as plain, prosaic fact." The role of eloquence within information design is the first step on merging the two universes, à la Da Vinci. The fact is that creative expression has existed side by side with scientific inquiry since the start of recorded history. While the Cartesian dualism complicates the understanding of how the mind and body are integrated, there is a fundamental relationship among them, and between science and the fine arts. Verifying *only the facts* denies us our heritage and our senses as together the processes of inquiry—fact and feeling—are integrated however the boundaries are defined or defended. Therefore, I propose this genre of engagement, of study, of acceptance: that of the *visual limnologist*.

TECHNICAL NOTES

For the majority of my work and time at Lake Powell, I carried a Horseman 4×5 view camera, tripod, dark cloth, black-and-white and color negatives, and, for a time, Polaroid instant positive/negative film. There have been periods of time when wind and weather, light and darkness were not conducive to photography, and I returned to my laboratory at the University of Nevada, Reno, without having exposed a single sheet of film. My camera has been absorbed in whirlwinds, slipped down the angle of repose into a watery grave, dangled above cliffs, and swayed by the swells of passing houseboats. Since the onset of digital technologies, I've worked with Canon cameras and most recently with a medium-format Mamiya, a computer-driven, full-sensor, 45-megapixel extension into the next era of technical photography. The foldout initiating the chapter on Low Water, page 91, was made with this camera and assembled by hand and computer in the laboratory. For the record, the reason that some plates have a different aspect ratio is because of the original negative or file format. The photographs date from 1987 through 2014.



DESCRIPTIONS OF PHOTOGRAPHS

xi	Dancing light, Fiftymile Canyon
xii	Last light and May storm, Ribbon Canyon
xv	Last light, Bullfrog Marina from Defiance Lodg
xvi	Forgotten Canyon, 99 percent full pond, 3,698.47 feet, June 1987
7	Found eyeglasses, Iceberg Canyon
9	Submerged green chair, Cedar Canyon
10	Anchor chain, Iceberg Canyon
11	Makeshift danger buoy, high above low water, Forbidden Canyon
13	Shade structure skeleton, Moqui Canyon
14	Camp chair skeleton, Forbidden Canyon
16	Sunken shade canopy, Crystal Canyon
17	Pseudolith, Long Canyon
18	Rocket launcher, Lost Eden Canyon
21	Largemouth bass lure in tree, Iceberg Canyon
22	Lures in branches, Iceberg Canyon
25	Makeshift danger buoy, Moqui Canyon
26	Boat ladder, Cedar Canyon
27	Rope ladder and Moqui steps, Moqui Canyon
28	Sunken cruiser, east of Escalante River
29	Buried shoe, Scorup Canyon
31	Suspended and sunken boat, Ribbon Canyon

32	Fishnet skeleton, Good Hope Bay
47	Candle wax, insects
49	<i>Eriogonum heermannii</i> , Heermann's buckwheat—Polygonaceae (knotweed family), Fiftymile Wash, Escalante River
51	Dug-up fish carcasses, Slick Rock Canyon
52	Fish bone, Good Hope Bay
55	Carp, Halls Crossing Marina
56	Fish boardshorts, Knowles Canyon
58	Footprints, Scorup Canyon
59	Fauna tracks, Cedar Canyon
61	Shells, Sevenmile Canyon
62	Handheld tumbleweed, Ticaboo Canyon
63	Submerged tumbleweeds, Knowles Canyon
64	Contemporary vernacular petroglyphs, The Coves
65	Naming rock, Crystal Springs Canyon
66	Flying tent, North Gulch, Moqui Canyon
67	Floating figure, Padre Canyon
69	Impending storm near Gunsight Pass, Padre Canyon
70	Shadow figure, last light, Hansen Creek Canyon
73	Reflections, figure or scale, Crystal Canyon
91	Low water, Moqui Canyon
92	Hand pictographs, Moqui Canyon
93	Cave, Fiftymile Wash, Escalante River
95	Reflections, trees, canyon walls, Lake Canyon
96	Mirrored low water landscape, Lake Canyon

97	Bimini framed landscape, Anasazi Canyon
99	Sentinel tree, Lake Canyon
101	Waterfall, Sevenmile Canyon
102–103	Tapestry Wall, Colorado River
105	Dead tree, shadow, Iceberg Canyon
106	Swinging figure, Mo ui Canyon
107	Dead, burnt trees, Forbidden Canyon
109	Solitary burnt tree, Forbidden Canyon
111	Trickling water, Iceberg Canyon
112	Tributary, low water, Hansen Creek
113	Mercurial water, Sevenmile Canyon
114	Low water, photographic research vessel, Iceberg Canyon
115	Low water line, Good Hope Bay (distant view)
116–117	Houseboat moorage, Willow Creek Canyon, Escalante River
118	Receding waters, dead trees, Lake Canyon
119	Driftwood line, Good Hope Bay
121	View from a driftwood beach, farthest upriver point reachable by boat at Lake Powell in 2014
134–135	Tumbleweed growing—and burning—within campfire ring near Jacks A ch, San Juan River
137	Fire in water, Sevenmile Canyon
138	Fire ring, Padre Bay
146	Burning tumbleweed, mouth of Escalante River
161	Chair, Warm Springs Canyon

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Many people helped make this book possible, including those anonymous and well-known photographers whose visions help define Glen Canyon. However, a few of my colleagues deserve special mention because of their good humor, gracious understanding, and unselfish assistance: Dennis Albrecht is my friend and traveling assistant for almost all of the years I've traveled to Lake Powell. He was there on the very first trip out of Hite in the summer of 1987, and lived through running out of gas with a seventeen-foot open-hull what-were-we-thinking aluminum skiff. Nancy and Harvey Fennell graciously loaned me a twenty-two-foot Reinell cabin cruiser, and we hauled it from Reno to Lake Powell and back. Scott Hinton, coordinator of photographic research and administrative faculty member at the University of Nevada, Reno, accompanied me on two of the most productive and recent explorations of Lake Powell from Bullfrog to as close to Hite as we could get. He manages the photographic laboratories at the University of Nevada, Reno, and supports and supervises the volunteers who provided invaluable research assistance, scanning, and preparing for publication those early 4×5 negatives. Scott worked professionally converting the (4×5 sequence) quadriptych of the first gatefold in the book into the desired panorama. Photographed at almost a full pool, that panorama measures 20" x 100" on 24" x 106" Hahnemühle watercolor 350 gsm paper. This view is a rare, large-scale photograph of Lake Powell in the earliest days of high water. Katrina Windon, archivist, supported work on Lake Powell's archive materials, and Forrest Pelsue and Estefania Cervantes Aviles contributed with image management and preparation.

Once this project began, it took on a life of its own. For the most part, the field work was self-funded. Concurrently, I am working on two major publications on Lake Tahoe, and as a result of that effort, I acquired a photographic research vessel (PRV), a seventeen-foot aluminum-hull fishing boat converted for photographic use. For the last three field work sessions at Lake Powell, I hauled the PRV to Wahweap Marina and subsequently to Bullfrog Marina, whereupon I had greater ability to move throughout the canyons and byways of Lake Powell.

Funding for the publication of this book came in part through a Scholarly and Creative Activities Grant from the College of Liberal Arts, University of Nevada, Reno; from the Black Rock Institute; and from a significant donation from Jessica L. Ledbetter, for whom I will be forever grateful. All the photographs are exhibition size and quality.

Producing the photographs has been primarily a solitary experience; Lake Powell's overwhelming grandeur, red canyons, and blue skies present a sizeable tableau. On a trip just a few years ago, my friend Dennis and I cowboy camped, watching the sun beat the sand eroding the shade. I've slept on airbeds on exposed rock and enjoyed light breezes caressing dawn's emergence. Visual memories persevere and include, but are not limited to, fish smacking the water's surface, Spanish rice, kidney beans and pork, steak and chicken, calm and quiet. Ah, the solace of solitude, knowing that we were enjoying a moment within a conundrum called Lake Powell. Acknowledging Glen Canyon and Lake Powell, and their origins and the history of the place, is of paramount importance.

—Peter Goin

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It's not possible to write about Glen Canyon and Lake Powell without being moved and inspired by the wisdom and passion of someone who was there before the beginning, the inimitable Katie Lee, who has been gracious enough to provide her archive to NAU's Cline Library.

Finally, the essays certainly would not have grown into their final form without the love and unending support of Michele and Liam, faithful traveling companions who are always along in spirit even when they're staying at home.

—Peter Friederici

NOTES

- vii *Nineteenth century . . . of rivers*
The epigraph is from “Elements” by Ann Weiler Walka, in her book *Waterlines: Journeys on a Desert River* (Flagstaff: Red Lake Books, 2000), 44–45.

THE NAMES

- 35 *fi e hundred pounds for every man, woman, and child*
E. D. Andrews, “Sediment Transport in the Colorado River Basin,” *Colorado River Ecology and Dam Management: Proceedings of a Symposium, May 24–25, 1990, Santa Fe, New Mexico* (Washington, DC: Academy Press, 1991), 68.
- 37 *his best-selling account of the expedition*
J. W. Powell, *The Exploration of the Colorado River and Its Canyons* (New York: Dover, 1961), 247.
- 39 *The principal water source for forty million people in the United States and Mexico*
U.S. Bureau of Reclamation, *Colorado River Basin Water Supply and Demand Study*, December 2012, http://www.usbr.gov/WaterSMART/bsp/docs/finalreport/ColoradoRiver/CRBS_Executive_Summary_FINAL.pdf.
- 39 *it has been deemed responsible for one-twelfth of the entire country’s gross domestic product*
T. James, A. Evans, E. Madly, and C. Kelly, *The Economic Importance of the Colorado River to the Basin Region*, L. William Seidman Research Institute, Arizona State University, December 18, 2014.
- 40 *a level of a hundred feet below its full pool*
The Bureau of Reclamation documents Lake Powell water levels and reservoir volume at <http://www.usbr.gov/uc/water/crsp/cs/gcd.html>.

ROUND RIVER

- 75 *the union that resulted in the birth of Lake Powell*
The comprehensive account of the dam's construction is in Russell A. Martin's book *A Story That Stands Like a Dam: Glen Canyon and the Struggle for the Soul of the West* (New York: Henry Holt, 1989). For a broader account of how the dam and the Colorado River fit into post-war water planning in the West, see Marc Reisner's classic *Cadillac Desert: The American West and Its Disappearing Water* (New York: Viking, 1986).
- 76 *Buzz Belknap reflected*
Walter Meayers Edwards, "Lake Powell: Waterway to Desert Wonders," *National Geographic*, July 1967: 75.
- 76 *Richard Shelton put it*
The poem is "Glen Canyon on the Colorado," anthologized in *The Forgotten Language: Contemporary Poets and Nature*, ed. Christopher Merrill (Salt Lake City: Peregrine Smith, 1991).
- 78 *The dam shuddered*
A compelling and informative contemporary account is in T. J. Wolf's "How Lake Powell Almost Broke Free of Glen Canyon Dam This Summer," *High Country News*, December 12, 1983, 10–14.
- 78 *raised havoc on the river runners*
For a highly readable account of both the dam's peril and the effects downstream, see Kevin Fedarko's *The Emerald Mile: The Epic Story of the Fastest Ride in History Through the Heart of the Grand Canyon* (New York: Scribner, 2013).
- 79 *The Hopi say*
Hopi elder and former tribal chairman Vernon Masayesva of the Black Mesa Trust described this view of the water cycle at the Braiding Through Water conference, April 2009, in Flagstaff.
- 79 *its concentration of carbon dioxide*
Measurements of the concentration are from the benchmark monitoring project at the Mauna Loa observatory, National Oceanic and Atmospheric Administration Earth System Research Laboratory, <http://www.esrl.noaa.gov/gmd/ccgg/>.
- 79 *by about a couple of degrees Fahrenheit*
G. Garfin, A. Jardine, R. Meredith, M. Black, and S. LeRoy, *Assessment of Climate Change in the Southwest United States: A Report Prepared for the National Climate Assessment* (Washington, DC: Island Press, 2013).

- 80 *half a million acre-feet of water—163 billion gallons*
The figure comes from a calculation in G. C. Jacoby, Jr., R. A. Nelson, S. Patch, and O. L. Anderson, “Evaporation, Bank Storage, and Water Budget at Lake Powell,” *Lake Powell Research Project Bulletin* 48 (1977), archived at http://www.gcmrc.gov/library/reports/biological/Lake_Powell/Jacoby1977.pdf.
- 80 *a 2 percent increase in evapotranspiration*
Niklas S. Christensen and Dennis P. Lettenmaier, “A Multimodel Ensemble Approach to Assessment of Climate Change Impacts on the Hydrology and Water Resources of the Colorado River Basin,” *Hydrology and Earth System Sciences Discussions* 3 (2006): 3727–70.
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G. Garfin, A. Jardine, R. Meredith, M. Black, and S. LeRoy, *Assessment of Climate Change in the Southwest United States*: chapter 6.
- 81 *Will the overall amount of rain or snow they see change?*
The numerous studies that have addressed this issue are effectively summarized in G. Garfin, A. Jardine, R. Meredith, M. Black, and S. LeRoy, *Assessment of Climate Change in the Southwest United States*, chapter 6.
- 81 *According to a study that looked at precipitation patterns in the southwest United States since 1979*
A. F. Prein, G. J. Holland, R. M. Rasmussen, M. P. Clark, and M. R. Tye, “Running Dry: The U.S. Southwest’s Drift into a Drier Climate State,” *Geophysical Research Letters* 43 (2016), doi: 10.1002/2015GL066727.
- 81 *Whether precipitation falls as rain or snow matters*
W. R. Berghuijs, R. A. Woods, and M. Hrachowitz, “A Precipitation Shift from Snow Towards Rain Leads to a Decrease in Streamflow,” *Nature Climate Change* 4 (2014): 583–86.
- 81 *For each 1 percent decline in precipitation in the Colorado River basin*
J. A. Vano, T. Das, and D. Lettenmaier, “Hydrologic Sensitivities of Colorado River Runoff to Changes in Precipitation and Temperature,” *Journal of Hydrometeorology* 13 (2012): 932–49.
- 81 *according to an analysis of nineteen different climate models*
Michael Wehner et al., “Projections of Future Drought in the Continental United States and Mexico,” *Journal of Hydrometeorology* 12 (2011): 1359–77.

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J. C. Neff, A. P. Ballantyne, G. L. Famer, N. M. Mahowald, J. L. Conroy, C. C. Landry, J. T. Overpeck, T. H. Painter, C. R. Lawrence, and R. L. Reynolds, “Recent Increase in Eolian Dust Deposition Related to Human Activity in the Western United States,” *Nature Geoscience* 1 (2008): 189–95.
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Thomas H. Painter, Jeffrey S. Deems, Jayne Belnap, Alan F. Hamlet, Christopher C. Landry, and Bradley Udall, “Response of Colorado River Runoff to Dust Radiative Forcing in Snow,” *Proceedings of the National Academy of Sciences of the United States of America* 107, no. 40 (October 5, 2010): 17125–30.
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Stephanie L. Castle, Brian F. Thomas, John T. Reager, Matthew Rodell, Sean C. Swenson, and James S. Famiglietti, “Groundwater Depletion During Drought Threatens Future Water Security of the Colorado River Basin,” *Geophysical Research Letters*, 2014, doi: 10.1002/2014GL061055.
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Balaji Rajagopalan, Kenneth Nowak, James Prairie, Martin Hoerling, Benjamin Harding, Joseph Barsugli, Andrea Ray, and Bradley Udall, “Water Supply Risk on the Colorado River: Can Management Mitigate?” *Water Resources Research* 45 (2009), W08201, doi: 10.1029/2008WR007652.
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Energy Information Administration, *Annual Energy Outlook 2011 with Projections to 2035*, Report No. DOE/EIA-0383 (2011) (Washington, DC: Department of Energy, 2010).
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Pat Mulroy, “Lake Mead Levels Not Just Vegas’ Problem,” *Las Vegas Sun*, August 20, 2014, <http://www.lasvegassun.com/news/2014/aug/20/lake-mead-levels-not-just-vegas-problem/>.
- 83 *"dammed at the source"*
Bill McKibben, *The End of Nature* (New York: Random House, 1989), 178.
- 83 *The atmosphere’s growing heat shifts the baseline toward aridity*
D. R. Cayan, T. Das, D. W. Pierce, T. P. Barnett, M. Tyree, and A. Gershunov, “Future Dryness in the Southwest US and the Hydrology of the Early 21st Century Drought,” *Proceedings of the National Academy of Sciences* 107 (2010): 21271–76.

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Toby R. Ault, Julia E. Cole, Jonathan T. Overpeck, Gregory T. Pederson, and David M. Meko, "Assessing the Risk of Persistent Drought Using Climate Model Simulations and Paleoclimate Data," *Journal of Climate*, 2014, doi: 10.1175/JCLI-D-12-00282.1.
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B. I. Cook, T. R. Ault, and J. E. Smerdon, "Unprecedented 21st Century Drought Risk in the American Southwest and Great Plains," *Science Advances* 1 (February 12, 2015): e1400082.
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For entertainingly dystopian views of what a future Phoenix might look like, see James Lawrence Powell's *Dead Pool: Lake Powell, Global Warming, and the Future of Water in the West* (Berkeley: University of California Press, 2008) or Paolo Bacigalupi's novel *The Water Knife* (New York: Knopf, 2015). William deBuys's *A Great Aridness: Climate Change and the Future of the American Southwest* (New York: Oxford, 2011) also provides a sobering look into the future.
- 85 *a group of hydrologists and climatologists*
P. C. D. Milly, Julio Betancourt, Malin Falkenmark, Robert M. Hirsch, Zbigniew W. Kundzewicz, Dennis P. Lettenmaier, and Ronald J. Stouffer, "Stationarity Is Dead: Whither Water Management?" *Science* 319 (2008): 573–74. For a more focused look at the Colorado River specifically, see T. P. Barnett and D. W. Pierce, "When Will Lake Mead Go Dry?" *Water Resources Research* 44 (2008): W0301.
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Annette McGivney's beautiful book *Resurrection: Glen Canyon and a New Vision for the American West* (Seattle: Braided River, 2009) provides an in-person look at what happens to the Colorado's once-drowned tributaries in the face of the lake's withdrawal.
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Figures from the U.S. Census Bureau, <http://quickfacts.census.gov/qfd/states/04000.html>.
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Arizona Department of Water Resources, *Arizona's Next Century: A Strategic Vision for Water Supply Sustainability*, last modified June 1, 2015, http://www.azwater.gov/AzDWR/Arizonas_Strategic_Vision/.

THE UNCHARTED

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P. Slovic, *The Perception of Risk* (London: Earthscan, 2000).
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P. Friederici, "Private Memories of Public Precipitation: Gathering and Assessing Ecological Oral Histories in an Era of Climate Change," in *The Land Speaks: New Voices at the Intersection of Oral and Environmental History*, ed. Debbie Lee and Kathryn Newfont (New York: Oxford, in press).
- 130 *And the Hopi know why*
Interview with Hopi elder Ferrell Secakuku by Shawn Kelley, in *What Has Passed and What Remains: Oral Histories of Northern Arizona's Changing Landscapes*, ed. Peter Friederici (Tucson: University of Arizona Press, 2010), 145–59; Marilyn Berlin Snell, "The Rainmaker: A Hopi Leader Champions Clean Power in Indian Country," *Sierra*, January/February 2007: 16–19.

PHOTOGRAPHER'S NOTE

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From Evans's lecture "Lyric Documentary" given at Yale University on March 11, 1964, p. 38; text of talk included in the Walker Evans Archive at the Metropolitan Museum of Art in New York.



ABOUT THE PHOTOGRAPHER

PETER GOIN, Foundation Professor of Art at the University of Nevada, Reno, produces photographs dealing with the long-term impact of culture and technology on the environment. Using the language of the fine arts, Goin's work integrates history, architecture, urban planning, and the social and political sciences in an interdisciplinary manner. He has published seventeen books with such prestigious publishers as Johns Hopkins University Press, the University of California Press, the University of Chicago Press, the University of Texas Press, the Center for American Places, and Norton Publishers.

Goin's work is included in more than forty-three major collections, ranging from the Whitney Museum of Art and the Museum of Modern Art in New York to the San Francisco Museum of Modern Art. The Library of Congress alone owns 350 of his photographs. His exhibitions have appeared in innumerable topflight museums, and his internationally acclaimed book *Nuclear Landscapes* has inspired many subsequent studies of the Nevada Nuclear Test Site. He is well known as a cultural critic, master photographer, and videographer. His video work on the Burning Man festival is Emmy nominated; his hour-long program on adolescence won the Best Experimental Documentary Video Award at the New York International Film and Video Festival.

Embracing a lyrical and poetic vision of both place and books, Goin has photographed around, about, and within Glen Canyon for almost three decades. He lives in Reno, Nevada.

ABOUT THE ESSAYIST

PETER FRIEDERICI writes about connections between humans and nature. He is the author of several books, including *Nature's Restoration: People and Places on the Front Lines of Conservation* and *The Suburban Wild*. His essays have been collected in several anthologies, including *The Best American Spiritual Writing*. He regularly contributes reportage and essays to periodicals ranging from *Audubon* and *Orion* to the *High Country News* and *InsideClimate News*. His reporting for *High Country News* was recognized with a reporting award from the Society of Environmental Journalists.

Friederici directs the Master of Arts in Sustainable Communities program at Northern Arizona University, where he has overseen a wide range of inquiry, reporting, and writing by both undergraduate and graduate students. Some of his students' oral history investigations of environmental change were compiled for the book *What Has Passed and What Remains: Oral Histories of Northern Arizona's Changing Landscapes*.

A former field biologist and wilderness tour guide, Friederici lives in Flagstaff, Arizona, where he gardens, raises a family, works on restoring old houses, and tries to find time to explore the canyon country of northern Arizona and southern Utah whenever he can.